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ABSTRACT

Continuing a series of short tests aimed at measuring student mastery of specific skills in the natural sciences, this supplementary volume includes teachers' notes, a users' guide and inspection copies of test items 27 to 50. Answer keys and test scoring statistics are provided. The items are designed for grades 7 through 10, and a list of the mastery program tests is included with ordering information. (CM)

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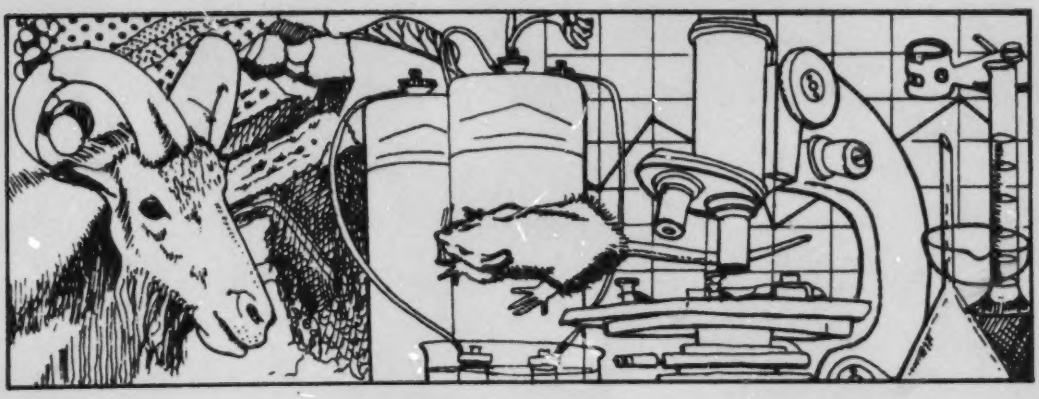
SCIENCE

MASTERY TESTING PROGRAM



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SERIES 3&4 SUPPLEMENTS TO INTRODUCTION AND MANUAL

VOLUME EIGHT OF THE SCIENCE LIBRARY OF TEST ITEMS

TM 820 305

SUPPLEMENT TO ISBN 0-7240-4108-7

SCIENCE

MASTERY TESTING PROGRAM

SERIES 3 & 4 SUPPLEMENTS TO

MASTERY TESTING INTRODUCTION AND MANUAL

Produced by SCHOOL CERTIFICATE DEVELOPMENT UNIT, DIRECTORATE OF STUDIES, 1980

This Supplement has been prepared as a continuing aid for Science teachers in their usage of Mastery Testing with students in Years 7-10.

Further supplements will be issued as companion volumes to the original "Mastery Testing - Introduction and Manual".

These supplements are part of the Science Library of Test Items and, as with all previous publications, we welcome your comments and suggestions for future development.

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INTRODUCTION

This manual is designed as a supplement to the "Mastery Testing Programme - Introduction and Manual" which was distributed to all High and Central Schools in 1978. The original manual was intended to supply all the information a teacher might need about the mastery testing programme.

It contained an overview of the mastery approach to learning, and the related aspects of testing for mastery. Stress was placed on the nature of a criterion - referenced test rather than the norm referenced test which is more commonly used in schools.

In addition, the introduction contained a set of keys for Mastery Tests 1 - 26, and an inspection set of each of these tests for teachers to use in deciding the appropriateness of each test to individual teaching programmes.

Series 3 and 4 Mastery Tests (Nos.27 - 50) have now been issued to schools, and this supplementary manual is designed to accompany those tests.

The format of this manual is slightly different - the inspection set of tests shows only the actual test section, while the Teacher's Notes have been grouped together for easy reference as a Users' Guide.

An order form was included in the "Introduction and Manual" for schools to indicate those tests which were required. Any school which ordered tests on this form will continue to receive copies of all mastery tests which become progressively available without any need to re-order each series.

However, some schools did not avail themselves of the offer to obtain series 1 and 2 and now, having received series 3 and 4 wish to receive the original two series. A new order form is included in this edition for use by schools who did not order series 1 and 2.

INDEX of MASTERY TESTS CURRENTLY AVAILABLE

SERIES	TEST NO.	TITLE: A MASTERY TEST FOR THE SKILL OF:-
1	1	READING A TABLE
	2	USING A BIOLOGICAL KEY
	3	IDENTIFYING CHEMICAL SYMBOLS
	4	IDENTIFYING PARTS OF A HUMAN BODY (RESPIRATORY/ ALIMENTARY)
	5	READING A LINE GRAPH
	6	IDENTIFYING ELECTRONIC AND ELECTRICAL SYMBOLS
	7	NAMING LABORATORY APPARATUS
	8	IDENTIFYING LABORATORY APPARATUS
	9	IDENTIFYING THE BONES OF A HUMAN SKELETON - FORM A: TECHNICAL NAMES.
	10	IDENTIFYING THE BONES OF A HUMAN SKELETON - FORM B: COMMON NAMES.
	11	NAMING THE BRANCHES OF SCIENCE
	12	CONVERTING METRIC MASS (Kg AND g)
	13	IDENTIFY HAZARDS IN A LABORATORY
2	14	CALCULATING AN AVERAGE
	15	IDENTIFYING PARTS OF THE SCIENTIFIC METHOD
	16	READING A GEOLOGICAL MAP
	17	IDENTIFYING ELEMENTS, MIXTURES AND COMPOUNDS
	18	USING OHM'S LAW IN CALCULATIONS
	19	INTERPRETING FOOD CHAINS, WEBS AND PYRAMIDS
	20	MEASURING ANGLES OF INCIDENCE, REFLECTION AND REFRACTION
	21	CALCULATING KINETIC ENERGY
	22	USING F = Ma
	23	USING A TABLE OF GEOLOGICAL PERIODS
	24	USING SCIENTIFIC NOTATION 2
	25	MANIPULATING EQUATIONS
	26	UNDERTAKING EXPERIMENTAL DESIGN.
3	27	READING FROM A GRID PLAN
	28	IDENTIFYING COMMON INVERTEBRATES
	29	IDENTIFYING COMMON CHARACTERISTICS OF VERTEBRATES
	30	IDENTIFYING ELEMENTS FROM DESCRIPTIONS
	31	USING SCIENTIFIC NOTATION PART 1
	32	CLASSIFYING MINERALS
	33	APPLYING THE ACTIVITY SERIES OF METALS
	34	INTERPRETING TICKER TAPES
	35	PREDICTING THE DIRECTION OF A MAGNETIC FIELD 1
	36	PREDICTING THE DIRECTION OF A MAGNETIC FIELD 2
	37	DIVIDING IN SCIENTIC NOTATION
	38	USING OHM'S LAW.

SERIES	TEST NO.	TITLE: A MASTERY TEST FOR THE SKILL OF:-
4	39	USING A CODE (1)
	40	NAMING THE PARTS OF A MICROSCOPE AND IDENTIFYING THEIR FUNCTIONS
	41	CALCULATING DENSITY AND PREDICTING FLOTATION
	42	ESTIMATING METRIC LENGTH (MILLIMETRES AND METRES)
	43	USING SI SYMBOLS
	44	USING s=vt
	45	APPLYING A NOVEL THEORY
	46	CALCULATING MICROSCOPE MAGNIFICATIONS
	47	IDENTIFYING TRENDS IN DATA
	48	CALCULATING AVERAGES IN PRACTICAL SITUATIONS
	49	APPLYING A THEORY OF GENETICS
	50	MULTIPLYING IN SCIENTIC NOTATION.

"LET ME SEE NOW..... WOULD THAT BE UNDER "M" FOR MICROSCOPE, OR "C" FOR CALCULATING, OR "A" FOR APPARATUS, OR "S" FOR SKILL, OR "T" FOR TEST, OR "M" FOR MASTERY, OR ..... "

TEACHERS' NOTES

These tests are designed to determine whether or not a student has mastered particular "skills" in the science domain. Each test is involved with a single "skill" only, although some tests may be viewed as fitting in to a learning sequence, such that the skill being tested presupposes mastery of lower-order related skills.

All of the tests have been pretested on a wide range of students from both metropolitan and country schools throughout the state. Where possible, tests were administered to students in years 7 - 10, although the nature of some tests has restricted their applicability to one year only.

Recommended Mastery Scores:-

The final decision as to the score which indicates mastery must lie with the classroom teacher. Generally, a student achieving a score of 8 out of 10 should be regarded as having mastered the skill. However, in certain circumstances scores as low as 6 out of 10, or as high as 9 out of 10 may be more appropriate.

Indeed, if a sequence of learning experiences and related mastery tests is to be used, then evidence exists* that successively raising mastery criteria across the series of tests tends to:-

(i) increase the percentage of students completing early units in the sequence

(ii) enhance the rate at which units are completed

(iii) reduce the number of test attempts necessary to demonstrate mastery on a unit

(iv) decrease the proportion of students failing to complete the course.

In order to help in the teacher's decision re the mastery criterion, a table of percentages of candidates scoring at or above a particular score was included for tests in series 1 and 2. This practice has only been continued for tests 27 - 38 where possible.

FOOTNOTE

* Reference:- Carlson J.G. and Minke K.A. Fixed and Ascending Criteria for Unit Mastery Learning. Journal of Educational Psychology - 1975, 67, 96-101

Cumulative percentages will not be quoted after test 38, since it is stressed that where tests contain sets, the performance on sets within the test may be of more importance than the total test score. The teacher is urged, whilst initially considering the total score, to closely monitor the individual set scores and ask the question: - "why has the student done poorly - is it because of a weakness in one of the areas tested in a particular set?".

Consider the following students on M27

STUDENT	SET 1	SET 2	SET 3	SET 4	TOTAL	MASTERY
1	4	4	5	3	16	✓
2	5	5	1	5	16	✓
3	4	5	4	5	18	✓
4	5	5	4	5	19	✓
5	5	5	3	1	14	×

Students 1,2, 3 and 4 are all credited as mastering the skill. However, close inspection will show that only 3 and 4 have clearly mastered all aspects.

Students 1,2 and 5 all have some problems in particular sets, and these should be identified for individual help by the teacher.

Mastery tests are very useful diagnostic tools - but an overall score without reference to individual sections will not provide satisfactory information. Perhaps it may be akin to the medical report that you are "generally in good health - but your blood pressure is a little high." A wise doctor would not allow the problem area to go unchecked, even though the "overall score" was satisfactory. So it should be with the teacher - diagnosis is important as a detector of the need for remediation.

I WORK A FIVE-DAY WEEK, WITHOUT PAY, PLUS HOMEWORK AND THIS IS THE THANKS I GET!!

A USERS' GUIDE

This test is designed to determine whether or not the student can use a simple grid plan.

M27

Set Scores:

Low scores on certain sets of questions may indicate specified problems as indicated below:

Set 1: Lack of familiarity with names of shapes.

Set 2:

Set 3: This set is more complex: "clerical" errors are more likely, as students are required to locate two grid squares and add the contents.

Related Tests:

Many of the tests in the Mastery Testing Programme use diagrams with superimposed grids. This test is designed as a diagnostic toll to identify students whose problem is *not* failure to master the specified skill so much as difficulty in understanding the test format and/or context.

This test is thus primarily intended as a *diagnostic test*, rather than as a test to allow certification of achievement. It would also be useful as a *readiness test*.

This test is designed to determine whether or not the student can identify common representative invertebrates from drawings.

M28

Related Tests:

021032 Recognising invertebrate classes.

021034 Naming common invertebrates.

M29

This test is designed to determine whether or not the student can identify the common characteristics of vertebrates.

Related Tests:

M2 Using a biological key.

021032 Recognising vertebrate classes.

021033 Identifying common arthropods.

021034 Naming common arthropods.

Related skills for which tests have not been prepared:

Identifying common vertebrates.

M30

This test is designed to determine whether or not the student can identify elements, given written descriptions.

Related tests:

M17 Identifying elements, mixtures and compounds

Related skills for which tests have not been prepared:

Determining the properties of elements.

Identifying samples of elements.

This test is designed to determine whether or not the student can interpret numbers expressed in scientific notation.

M31

Recommended Mastery Score:

Only small samples were collected on this test. While they are sufficient to allow the test to be judged satisfactorily, they would be misleading as a guide to standards. For this reason, the details are not supplied, but it should be noted that this is a hard test.

Related tests:

M24 Using Scientific Notation Part 2

M37 Dividing Scientific Notation

Related skills for which tests have not been prepared:

Multiplying in Scientific Notation.

The Use of this Test:

This test is mainly intended as a *readiness test*. As such it would be used *before* a unit of work which required these operations. In such a case, a non-mastery score indicates a need for specific remedial help.

The test is also intended for use at the end of a unit of work which aims to develop these skills either alone, or with others. Once again, non-mastery scores suggest a need for remedial help.

This test is designed to determine whether or not the student can use descriptions of mineral properties to identify minerals.

M32

Set Scores:

Low scores on certain sets of questions may indiciate specific problems as indicated below:

Set 1: Difficulty in using a table of information (See M1, M23)

Set 2: Difficulty in using a table of information (See M1, M23)

Set 3: Unfamiliarity with mineral or properties named.

Related skills for which tests have not been prepared:

Determining properties of minerals.

Identifying real minerals.

M33

This test is designed to determine whether or not the student can supply the activity series of metals.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Sets 1 and 2: Inability to apply the order of the activity series of metals.

Set 3: Lack of understanding of the concept of displacement of metals.

Set 4: Inability to apply the order of the activity series of metals.
Inability to comprehend varying orders of metals.

Related skills for which tests have not been prepared:

Determining the activity series of metals.

M34

This test is designed to determine whether or not the student can interpret acceleration and deceleration from "ticker time" tapes.

Set Scores:

This test has not been divided into sets. The following points may be of some assistance:

Students who miss "A" responses: these students may be confused about the meaning of "acceleration", or the correct way to interpret "tape direction" Look at the "D" responses.

Students who miss "B" responses: these students may not understand what the diagrams represent, or they may have failed to use a ruler to measure distances between dots.

Students who miss "C" responses: as for B.

Students who miss "D" responses: these students may be confused about the meaning of "deceleration", or the correct way to interpret "tape direction" Look at the "A" responses.

Related tests: 021045 Calculating from ticker tapes.

Related skills for which tests have not been prepared:

Making records using ticker timers.

This test is designed to determine whether or not the student can estimate the direction of a magnetic field.

M35

Recommended Mastery Score:

Trials of this test were affected by lack of correct answers on two questions, and the small numbers taking the test in each year.

As a result, figures will not be supplied on this test, but teachers are assured that the faults have been removed.

In general, any student scoring 8 out of 10 on this difficult test should be regarded as having mastered the skill.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Unfamiliarity with conventions of representation.

Unfamiliarity with this situation.

Related skills for which tests have not been prepared:

Using compasses.

Making compasses.

Related tests:

M36 Predicting the direction of a magnetic field 2.

IT'S CALLED A SELF-INSTRUCTIONAL ACTIVITY. THAT MEANS YOU HAVE TO GET A CERTAIN AMOUNT DONE BEFORE THE TEACHER GETS BACK - OR SHE GETS MAD !!

M36

This test is designed to determine whether or not the student can predict the direction of a magnetic field.

Recommended Mastery Score:

Trials of this test were affected by lack of correct answers on two questions, and the small numbers taking the test in each year.

As a result, figures will not be supplied on this test, but teachers are assured that the faults have been removed.

In general, any student scoring 8 out of 10 on this difficult test should be regarded as having mastered the skill.

Set Scores:

Low scores may indicate specific problems as indicated below:

Unfamiliarity with conventions of representation.

Unfamiliarity with this situation.

Related skills for which tests have not been prepared:

Using compasses.

Making compasses.

Related tests:

M35 Predicting the direction of a magnetic field 1.

M37

This test is designed to determine whether or not the student can divide when both numerator and denominator are expressed in scientific notation.

Set Scores:

Each set is progressively harder, and calls for higher-order skills than the preceding sets. Problems with a particular subskill and/or item type will be apparent from the set scores. This test is mainly intended as a *readiness test*, and it may be that only one set need be administered at a given time.

Related tests:

M31 Using Scientific Notation 1
M24 Using Scientific Notation 2

Related skills for which tests have not been prepared:

Multiplying in Scientific Notation.

Converting to and from Scientific Notation.

M38

This test is designed to determine whether or not the student can understand and use Ohm's Law (as opposed to rote application of the equation).

Related tests:

M18 Using Ohm's Law

Related skills for which tests have not been prepared:

Measuring potential difference.

Measuring current.

Measuring resistance.

Connecting circuits.

M39

This test is designed to determine whether or not the student can use a code which they may be seeing for the first time.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Set 1: Low scores here indicate problems in understanding the Morse Code as it is supplied.

Set 2: This is a more complex form of Set 1.

Set 3: Low scores here indicate a basic problem with deciphering.

Set 4: This is a more complex form of Set 3.

Related tests:

021071 Using Codes 2

021072 Using Codes 3 (to be released as M64).

Related skills for which tests have not been prepared:

Constructing codes.

Interpreting non-verbal codes.

M40

This test is designed to determine whether or not the student can name the parts of a monocular microscope and identify the functions of the parts.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Set 1: This set is intended to measure familiarity with the names of the parts. A low score would suggest that the student may have difficulties following instructions on correct use of the microscope. Remedial drill may be indicated.

Set 2: This set is intended to determine whether the student understands the principles underlying his/her actions in using the microscope. This may not be essential in Years 7 and 8, but may well be necessary to students in Year 10 and proceeding to senior Science.

Related Tests:

M46 Calculating microscope magnifications.

Related skills for which tests have not been prepared:

Using a microscope

M41

This test is designed to determine whether or not the student can calculate density and apply the results in simple problem-solving.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Set 1: Lack of familiarity with concept and/or definition of density; Simple errors in calculations.

Set 2: Lack of experience with problems on flotation; Lack of familiarity with the concept and/or principles of flotation; Simple errors in calculations.

Related skills for which tests have not been prepared:

Measurement and calculation of densities.
Flotation predictions with real objects.

M42

This test is designed to determine whether or not the student can estimate size in millimetres and metres.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Set 1: Unfamiliarity with the length of a millimetre.
Problems with scaling up millimetres.
Unfamiliarity with the objects listed.

Set 2: Unfamiliarity with the length of a metre.
Problems with scaling up metres.
Unfamiliarity with some of the objects listed.

Set 3: Unfamiliarity with metric measurements.
Unfamiliarity with some items.

Related tests:

M58 Reading a linear scale.
M59 Converting metric length.

Related skills for which tests have not been prepared:

Estimating distance.
Measuring distances using different metric scales.

M43

This test is designed to determine whether or not the student can select the correct symbols for various metric units.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Set 1: Lack of familiarity with standard conventions of notation.
Problems in extracting information from the table (refer test M1)
Problems in converting from one code to another.
(See "Using Codes" M39, M64 and trial 021072).

Set 2: As for Set 1, but with more emphasis on decoding.

Set 3: As for Set 1, but these items are more complex.

Related tests:

M12 Converting metric mass.
M42 Estimating metric length.
M59 Converting metric volume.
021017 Converting metric volume.

Related skills for which tests have not been prepared:

Writing units.
Using units correctly in practical work.

M44

This test is designed to determine whether or not the student can carry out simple calculations, on time, velocity and distance.

Strictly speaking, this test is incorrect. The word "velocity" should be replaced with "speed" whenever it appears, since s = vt is a scalar equation, and only scalar data are used.

Against this, the use of "v" for speed, and "s" for distance may cause confusion. It appears that the use of "s" for distance, while unsatisfactory, is entrenched, and must be accepted. This test is thus a compromise between practice and propriety.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Set 1: Problems in manipulating equation to change subject.
Errors of subtitution or calculation.

Set 2: (Using the unaltered equation, placed second to avoid developing *response set* in students.)
Errors of substitution or calculation.

Set 3: As for Set 1.

Set 4: Diagnostic set on changing subject of equation.

Items 19 and 20 are of particular relevance to Sets 1 and 3.

Related tests:

M18 Using Ohm's Law in calculations
M21 Calculating kinetic energy
M22 Using F = ma
M34 Interpreting ticker tapes
021045 Calculating from ticker tapes

Related skills for which tests have not been prepared:

Measuring: distance, time, velocities.

M45

This test is designed to determine whether or not the student can apply a complex and novel theory to solve problems.

Set Scores:

Low scores on certain sets of questions may indicate specific problems.

In each case, errors in a set will indicate either a misunderstanding of the "theory", a misapplication of the "theory", an attempt to apply the normal atomic theory to the problem, or a mathematical error.

Teachers may wish to set free response questions in each of the formats used in this test: a consideration of such responses would be indicative of the nature of a student's error.

Related tests:

M49 Applying a theory of genetics
M51 Interpreting atomic numbers and mass numbers.

Related skills for which tests have not been prepared:

Formulating theories.
Developing theories.

M46

This test is designed to determine whether or the student can calculate the magnification of a microscope.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

- Difficulties in understanding the role of the eyepiece and objective in a microscope.
- Difficulties in performing the necessary calculations. TEACHERS MAY PREFER TO LEAVE SETS 3 AND 4 OUT WITH JUNIOR CLASSES

Related tests:

M25 Manipulating questions
M40 Naming the parts of a microscope.

Related skills for which tests have not been prepared:

- Using a microscope.
- Preparing slides for use.
- Staining techniques.
- Simple multiplication, division.
- Structure and use of telescopes and other optical instruments.

M47

This test is designed to determine whether or not the student can detect trends in data which are new to the student.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below.

Set 1: Difficulties in recognising mathematical relationships.

Set 2: Unfamiliarity with chemical formulae.
Difficulties in recognising mathematical trends in organic formulae.

Set 3: Difficulties in reading from a table.
Unfamiliarity with correct metric usage for large numbers (Q & S) Difficulties in extrapolating.
(Teachers should note that this is a *rounded-off* Koal. table. It should not be used as a teaching aid).

Related Tests:

M6 Reading a line graph
M14 Calculating an average
M34 Interpreting ticker tapes
021095 Reading a graph by interpolation

Related skills for which tests have not been prepared:

Detecting trends in graphs.
Making predictions based on trends.

M48

This test is designed to determine whether or not the student can calculate averages in a concrete situation.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Sets 1, 2 and 3: Problems in using decimal notation.
Lack of familiarity with conventions of calculating averages.
(Test M14 includes basic diagnostic features)
Problems with comprehension of question stems (See "Readability and Science Testing" and Comprehension Testing Programme).

Sets 2 and 3: Difficulties in making deductive conclusions.

Set 3: Difficulties with "reverse deduction".

Related tests:

M14 Calculating an average

Related skills for which tests have not been prepared:

Calculating an average without the cues and clues afforded by the multiple choice format.

M49

This test is designed to determine whether or not the student can manipulate complex information on Mendelian inheritance.

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below.

Misunderstanding of tabulated information.
Incorrect translation from word, symbol and diagram form.

Related tests:

021056 Completing a genetic table.

Related skills for which tests have not been prepared:

Developing a theory of genetics.
Manipulative skills with mice, *Drosophila* etc.

This test is designed to determine whether or not the student can multiply numbers written in scientific notation.

M50

Set Scores:

Low scores on certain sets of questions may indicate specific problems as indicated below:

Set1: Misunderstanding of meaning of numbers in scientific notation
Set 2: ((Misunderstanding of meaning of negative indices. Problems
Set 3: (with manipulating powers
Set 4: (of 10.

Related Tests:

M31 Using Scientific Notation Part 1*
M24 Using Scientific Notation Part 2*
M37 Dividing in Scientific Notation.

* Problems in carrying out trials resulted in test 2 being released earlier.

This test is intended to be used as a readiness test before commencing a science unit which requires this mathematical skill. Teachers may prefer to allow their students to use calculators, or even to work in groups.

ARE YOU GOING TO PROMOTE ME, OR LET YOURSELF IN FOR ANOTHER TERM OF TORTURE BY HAVING ME IN YOUR CLASS AGAIN FOR THIS UNIT OF WORK??

TEST STATISTICS FOR SELECTED SERIES 3 TESTS

N.B. Due to variations in sample size and availability of trial groups, statistics are not quoted for all tests. Although the numbers tested were sufficient to judge the tests satisfactory, their use as indicators of standards would be misleading.

M27

YEAR	NO. OF STUDENTS	SCORE								
		⩾20	⩾19	⩾18	⩾16	⩾14	⩾12	⩾10	⩾8	<8
7	82	71 %	88 %	93 %	94 %	98 %	98 %	98 %	100 %	-
8	48	83 %	96 %	98 %	100 %	100 %	100 %	100 %	100 %	-

In general a student achieving a score of 16 out of 20 should be regarded as having mastered this skill.

M28

YEAR	NO. OF STUDENTS	SCORE								
		⩾15	⩾14	⩾13	⩾12	⩾11	⩾10	⩾8	⩾6	<6
7	48	71 %	79 %	88 %	100 %	100 %	100 %	100 %	100 %	-
8	61	62 %	75 %	87 %	92 %	95 %	97 %	97 %	98 %	2

In general a student achieving a score of 12 out of 15 should be regarded as having mastered this skill.

M29

YEAR	NO. OF STUDENTS	SCORE								
		⩾19	⩾18	⩾17	⩾16	⩾15	⩾14	⩾12	⩾10	<10
7	79	1%	4%	15%	35%	52%	70%	95%	95%	1%
10	81	1%	7%	16%	26%	38%	53%	80%	91%	9%

The most difficult items were 9, 11, 14, 15 and 19. Minor amendments have been made.

In general a student achieving a score of 16 out of 20 should be regarded as having mastered this skill.

M30

YEAR	NO. OF STUDENTS	SCORE								
		≥15	≥14	≥13	≥12	≥11	≥10	≥8	≥6	<6
7	50	36%	40%	42%	42%	44%	52%	80%	96%	4%
8	59	15%	32%	44%	58%	69%	76%	92%	98%	2%

In general a student achieving a score of 12 out of 15 should be regarded as having mastered this skill.

This score will need to be adjusted if the student has not encountered some of the elements named.

M32

YEAR	NO. OF STUDENTS	SCORE								
		≥15	≥14	≥13	≥12	≥11	≥10	≥9	≥8	<8
9	30*	10%	33%	47%	67%	80%	93%	93%	100%	-
10	31*	6%	13%	32%	42%	71%	84%	90%	97%	3%

* Other smaller samples give similar results.

In general a student achieving a score of 12 out of 15 should be regarded as having mastered this skill.

M33

YEAR	NO. OF STUDENTS	SCORE								
		≥20*	≥19	≥18	≥17	≥16	≥14	≥12	≥10	<10
9	50	30%	56%	64%	66%	74%	94%	96%	98%	2%
10	58	3%	5%	9%	10%	17%	29%	57%	72%	28%

* In trials, question 20 had no correct answer. This has been allowed for in these figures.

In general a student achieving a score of 16 out of 20 should be regarded as having mastered this skill.

This score may need to be modified if students do not have access to an activity series table.

M34

YEAR	NO. OF STUDENTS	SCORE								
		≥20	≥19	≥18	≥16	≥14	≥12	≥10*	≥8	<8
9	33	15%	39%	48%	55%	55%	58%	76%	100%	-
10	95	15%	19%	23%	24%	25%	32%	66%	99%	1%

* This is due to students confusing acceleration and deceleration. The instructions have been amended to avoid this.

In general a student achieving a score of 16 out of 20 should be regarded as having mastered this skill.

M37

YEAR	NO. OF STUDENTS	SCORE								
		≥20	≥19	≥18	≥17	≥16	≥14	≥12	≥10	<10
		ONLY ONE YEAR TOOK PART IN THESE TRIALS								
10	147	29%	41%	48%	52%	57%	68%	76%	86%	14%

In general a student achieving a score of 16 out of 20 should be regarded as having mastered this skill.

M38

YEAR	NO. OF STUDENTS	SCORE								
		≥15	≥14	≥13	≥12	≥11	≥10	≥9	≥8	<8
8	54*	4%	11%	17%	46%	70%	78%	93%	96%	4%
10	95*	1%	3%	10%	26%	43%	63%	74%	87%	13%

* These samples are too small to allow any valid conclusions. The total sample was of the order of 200 students.

In general a student achieving a score of 12 out of 15 should be regarded as having mastered this skill.

"TWO TICKS AND THREE CROSSES. HEY, THAT'S GREAT!! A FULL HOUSE."

TEST KEYS

Test No.: M27

1 D 2 B 3 D 4 A 5 C 6 A 7 B 8 D 9 A 10 C

11 A 12 B 13 C 14 B 15 D 16 D 17 B 18 C 19 C 20 A

Test No.: M28

1 D 2 A 3 B 4 B 5 A 6 C 7 C 8 D 9 B 10 B

11 C 12 A 13 C 14 C 15 C

Test No.: M29

1 B 2 D 3 D 4 B 5 A 6 A 7 D 8 B 9 D 10 A

11 D 12 C 13 D 14 B 15 C 16 C 17 A 18 B 19 D 20 A

Test No.: M30

1 B 2 A 3 D 4 C 5 A 6 D 7 A 8 C 9 B 10 A

11 C 12 D 13 D 14 B 15 C

Test No.: M31

1 C 2 B 3 A 4 B 5 C 6 C 7 B 8 D 9 C 10 D

11 C 12 D 13 B 14 C 15 B 16 A 17 C 18 D 19 B 20 B

Test No.: M32

1 C 2 C 3 A 4 B 5 D 6 B 7 A 8 B 9 C 10 A

11 D 12 B 13 D 14 C 15 A

Test No.: M33

1 B 2 A 3 D 4 A 5 B 6 C 7 D 8 D 9 A 10 B

11 C 12 A 13 B 14 A 15 D 16 A 17 D 18 B 19 A 20 C

Test No.: M34

1 B 2 C 3 A 4 D 5 B 6 D 7 A 8 D 9 C 10 B

11 C 12 D 13 A 14 C 15 B 16 A 17 A 18 B 19 D 20 C

Test No.: M35

1 A 2 D 3 B 4 D 5 A 6 D 7 C 8 A 9 C 10 D

Test No.: M36

1 A 2 B 3 C 4 B 5 C 6 D 7 A 8 C 9 B 10 D

Test No.: M37

1 D 2 B 3 D 4 A 5 B 6 D 7 C 8 D 9 C 10 C

11 A 12 B 13 D 14 D 15 A 16 A 17 D 18 C 19 A 20 C

Test No.: M38

1 B 2 B 3 C 4 B 5 C 6 B 7 A 8 A 9 B 10 B

11 B 12 C 13 A 14 D 15 C

Test No.: M39

1 D 2 A 3 C 4 B 5 B 6 C 7 C 8 A 9 D 10 D

11 A 12 C 13 D 14 B 15 C 16 A 17 B 18 B 19 D 20 C

Test No.: M40

1 A 2 A 3 C 4 B 5 D 6 B 7 A 8 D 9 C 10 B

11 A 12 A 13 D 14 A 15 D 16 B 17 A 18 C 19 B 20 A

Test No.: M41

1 D 2 A 3 D 4 C 5 E 6 A 7 B 8 D 9 D 10 D

11 C 12 D 13 A 14 C 15 C

Test No.: M42

1 B 2 A 3 C 4 D 5 D 6 A 7 D 8 B 9 B 10 D

11 A 12 B 13 C 14 A 15 C 16 A 17 B 18 A 19 D 20 C

Test No.: M43

1 B 2 A 3 C 4 D 5 D 6 A 7 B 8 B 9 D 10 C

11 D 12 C 13 D 14 A 15 B

Test No.: M44

1 B 2 C 3 D 4 D 5 C 6 C 7 B 8 D 9 D 10 C

11 A 12 B 13 C 14 C 15 B 16 C 17 A 18 A 19 B 20 A

Test No.: M45

1 A 2 C 3 D 4 B 5 C 6 A 7 B 8 C 9 D 10 D

11 C 12 D 13 A 14 B 15 D 16 B 17 C 18 B 19 C 20 C

Test No.: M46

1 C 2 D 3 D 4 C 5 B 6 A 7 B 8 B 9 C 10 C

11 C 12 B 13 B 14 D 15 C 16 B 17 C 18 A 19 D 20 B

Test No.: M47

1 B 2 B 3 A 4 C 5 A 6 C 7 A 8 B 9 B 10 D

11 B 12 D 13 C 14 D 15 C

Test No.: M48

1 B 2 B 3 C 4 C 5 B 6 A 7 C 8 D 9 A 10 B

11 D 12 A 13 D 14 B 15 C

Test No.: M49

1 A 2 B 3 C 4 D 5 B 6 A 7 B 8 D 9 C 10 A

11 C 12 A 13 D 14 A 15 C

Test No.: M50

1 A 2 A 3 D 4 B 5 B 6 C 7 A 8 C 9 D 10 C

11 D 12 D 13 D 14 A 15 C 16 B 17 A 18 B 19 B 20 D

INSPECTION COPIES
SERIES 3 and 4
M27 to M50

The copies of Series 3 and 4 Mastery Tests are reproduced here as reductions, so that they may fit on a single foolscap page.

As with the "Introduction and Manual", only the actual test sections are reproduced - the teacher's notes have been included earlier in this supplement.

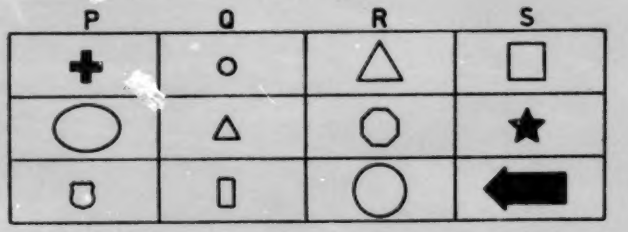
These reproductions should not be used as print masters since the reduced print is considered to be smaller than optimum size.

Having perused the inspection copies and selected the appropriate test(s), teachers are referred to the test pads for student copies. The pads contained either ten (10) or forty (40) copies of each test for student use.

Experience has shown that if student copies are adequately stored that the test sheets may be reused a large number of times. Some storage suggestions are included.

This test is designed to test your ability to use a simple grid of the type found on many street maps, and in many of the tests in this series.

The first ten questions refer to this diagram.



Set 1

Find the grid square which contains the shape named, and work out its grid reference. Find the letter (A, B, C or D) which matches your answer, and mark it on your answer sheet.

QUESTION	SHAPE	A	B	C	D
1	Star	P1	Q3	R1	S2
2	Rectangle	P2	Q3	R1	S2
3	Square	P3	Q1	R2	S1
4	Cross	P1	Q2	R3	S1
5	Large circle	P3	Q2	R3	S3

Set 2

Look at the grid square named, and decide what the shape in that square is called. Find the letter (A, B, C or D) which matches that name, and mark it on your answer sheet.

QUESTION	GRID SQUARE	A	B	C	D
6	P2	ellipse	rectangle	square	triangle
7	Q3	circle	rectangle	square	triangle
8	R1	circle	ellipse	star	triangle
9	R3	circle	rectangle	square	star
10	S2	cross	octagon	star	triangle

The next ten questions refer to this diagram.

	T	U	V	W
1	6	10	15	21
2	5	8	13	21
3	4	8	16	32

Set 3

Find the grid square which contains the number named, and work out its grid reference. Find the letter (A, B, C or D) which matches your answer, and mark it on your answer sheet.

QUESTION	NUMBER	A	B	C	D
11	6	T1	U2	V2	W2
12	16	V1	V3	W2	W3
13	13	T2	U3	V2	W1
14	10	T3	U1	V1	W3
15	15	T1	T3	U2	V1

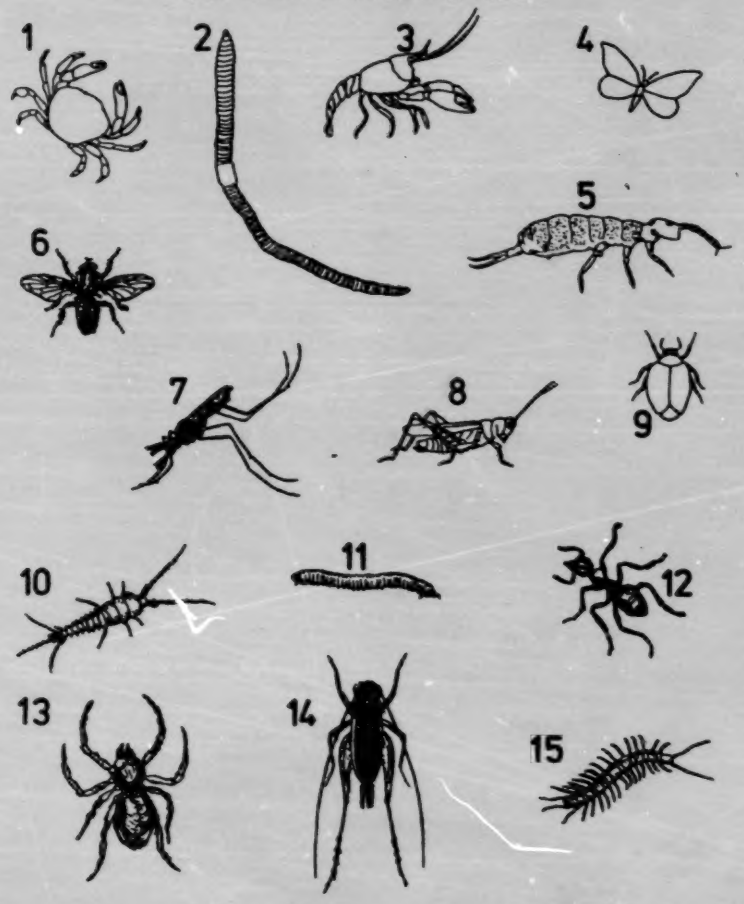
Set 4

Find the two grid squares which are named, and add together the numbers in the two squares. Find the letter (A, B, C or D) which matches your answer and mark it on your answer sheet.

QUESTION	SQUARES	A	B	C	D
16	T1 & U1	13	14	15	16
17	T2 & V2	13	18	20	21
18	U3 & W2	21	24	29	40
19	T1 & W1	21	26	27	34
20	T3 & W1	25	26	36	38

This test is designed to test your ability to identify common invertebrates (animals with no backbone). Look at the diagrams below, and then answer the questions opposite.

THESE ANIMALS ARE NOT DRAWN TO SCALE.

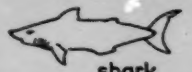
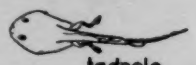


The questions on this page refer to the diagrams opposite. For each question, choose the drawing which matches the name. Mark your answer (A, B, C or D) on your answer sheet.

QUESTION	ANIMAL	A	B	C	D
1	Centipede	2	10	11	15
2	Butterfly	4	7	8	10
3	Fly	4	6	9	14
4	Springtail	3	5	8	10
5	Worm	2	10	11	15
6	Beetle	4	8	9	14
7	Ant	3	8	12	14
8	Cricket	3	7	8	14
9	Mosquito	4	7	8	14
10	Crayfish	1	3	5	10
11	Millipede	2	5	11	15
12	Crab	1	3	5	10
13	Grasshopper	3	7	8	14
14	Silverfish	8	9	10	15
15	Spider	9	12	13	14

This test is designed to measure your ability to identify the common characteristics of the groups of animals with backbones.

This table may help you to answer the questions on the opposite page correctly:

ANIMAL GROUP	EXAMPLES	
Fishes	 shark	boney fish
Amphibians	frog	 tadpole
Reptiles	tortoise	lizard
Birds	heron	penguin
Mammals	mouse	bat

In the questions opposite, decide which group (or groups) of animals fit the description. Find the letter (A, B, C or D) which matches your choice, and mark it on your answer sheet.

QUESTION	CHARACTERISTICS	A	B	C	D
1	Warm-blooded	Amphibians & mammals	Birds & mammals	Amphibians birds & mammals	Birds, mammals & reptiles
2	Covered with fur	Amphibians	Birds	Fish	Mammals
3	Covered with dry scales	Amphibians	Fish	Mammals	Reptiles
4	Covered with slimy scales	Amphibians	Fish	Mammals	Reptiles
5	Naked skins	Amphibians	Fish	Mammals	Reptiles
6	Covered with feathers	Birds	Fish	Mammals	Reptiles
7	Bear young alive	Amphibians	Birds	Fish	Mammals
8	Lay eggs with hard shells	Amphibians	Birds	Fish	Reptiles
9	Lay eggs with leathery shells	Amphibians	Birds	Fish	Reptiles
10	Lay eggs with no shells	Amphibians & fish	Amphibians & reptiles	Fish & reptiles	Amphibians fish & reptiles
11	Have a four chambered heart	Amphibians & reptiles	Mammals & reptiles	Amphibians & birds	Birds, & mammals
12	Suckle their young	Amphibians	Birds	Mammals	Reptiles
13	Look after young	Amphibians & birds	Amphibians & fish	Amphibians, birds & mammals	Birds & mammals
14	Breathe with lungs at some stage in their life cycle	Amphibians, birds & mammals	Amphibians, birds, mammals & reptiles	Amphibians, mammals & reptiles	Birds, mammals & reptiles
15	Breathe with gills at some stage in their life cycle	Amphibians	Fish	Amphibians & fish	Amphibians fish & reptiles
16	Always have internal fertilisation	Amphibians, mammals & reptiles	Birds, mammals & fish	Birds, mammals & reptiles	Birds, fish, mammals & reptiles
17	Have a larval and an adult stage	Amphibians	Fish	Amphibians & fish	Reptiles
18	Have fins	Amphibians	Fish	Amphibians & fish	Amphibians, fish & birds
19	Have wings	Amphibians & fish	Birds & reptiles	Amphibians & birds	Birds & mammals
20	Have arms and legs	Amphibians & mammals	Birds & mammals	Birds, mammals & reptiles	Amphibians, birds, mammals & reptiles

PROPERTIES OF COMMON ELEMENTS

Choose the element which has the properties listed and mark its letter (A, B, C or D) on your answer sheet.

QUESTION	CHARACTERISTICS AND PROPERTIES	ELEMENTS			
		A	B	C	D
1	Colourless gas. Burns to form water. Lightest gas.	Oxygen	Hydrogen	Chlorine	Iodine
2	Colourless gas relights a glowing splint, about 20% of the air.	Oxygen	Hydrogen	Nitrogen	Chlorine
3	Green-yellow gas, poisonous, bleaches objects.	Iodine	Nitrogen	Neon	Chlorine
4	Yellow solid, easily melted, burns with purple flame.	Magnesium	Copper	Sulfur	Chlorine
5	Colourless gas, does not burn, does not relight glowing splint.	Nitrogen	Hydrogen	Oxygen	Chlorine
6	Black solid, burns to form carbon dioxide.	Sulfur	Oxygen	Iodine	Carbon
7	Soft, dense metal easily melted, grey.	Lead	Sulfur	Iodine	Iron
8	The only metal which is liquid at room temperature.	Sodium	Bromine	Mercury	Oxygen
9	Hard grey metal, magnetic, rusts in moist air.	Magnesium	Iron	Copper	Zinc
10	Silvery metal used to galvanize iron.	Zinc	Silver	Lead	Sodium
11	Light metal, silvery, forms protective coating in air. Used in window frames.	Iron	Lead	Aluminium	Sodium
12	Fairly hard, light metal. Burns with brilliant flame.	Tin	Zinc	Aluminium	Magnesium
13	Very soft metal, reacts violently with water.	Tin	Iodine	Sulfur	Sodium
14	Dense shiny yellow metal. Precious, soft.	Sulfur	Gold	Iodine	Silver
15	Reddish metal, used to make fire hoods, water pipes, guttering, electric cables.	Silver	Gold	Copper	Aluminium

Please note: the spelling "sulfur" has been used in this test to conform with international practice as established by the I.U.C.

This test is designed to measure your ability to express numbers in scientific notation as a power of ten.

SET 1

Choose the correct answer and mark its letter (A, B, C or D) on your answer sheet.

Question	Number	Possible answers in scientific notation			
		A	B	C	D
1	100	10^0	10^1	10^2	10^3
2	1 000	10^2	10^3	10^4	10^5
3	1	10^0	10^1	10^2	10^3
4	40	4×10^0	4×10^1	4×10^2	4×10^3
5	60 000	6×10^2	6×10^3	6×10^4	6×10^5

SET 2

Choose the correct answer and mark its letter (A, B, C or D) on your answer sheet.

Question	Number	Possible Answers			
		A	B	C	D
6	2×10^3	2	20	200	2 000
7	3×10^1	3	30	300	3 000
8	4×10^3	4	40	400	4 000
9	8×10^5	800	8 000	80 000	800 000
10	7×10^6	70	700	70 000	7 000 000

SET 3

Choose the correct answer and write this letter (A, B, C or D) on your answer sheet.

Question	Number	Possible answer in scientific notation			
		A	B	C	D
11	.1	1×10^1	1×10^0	1×10^{-1}	1×10^{-2}
12	.22	22×10^0	2.2×10^0	22×10^{-1}	2.2×10^{-1}
13	.01	1×10^{-1}	1×10^{-2}	1×10^{-3}	1×10^{-4}
14	.004	4×10^{-1}	4×10^{-2}	4×10^{-3}	4×10^{-4}
15	.036	36×10^{-2}	3.6×10^{-2}	3.6×10^{-3}	36×10^{-4}

SET 4

Choose the correct answer and write this letter (A, B, C or D) on your answer sheet.

Question	Number	Possible Answers			
		A	B	C	D
16	1×10^{-1}	.1	.01	.001	.0001
17	1.2×10^{-2}	1.2	.12	.012	.0012
18	4.6×10^{-5}	.46	.046	.0046	.00046
19	5×10^{-3}	.5	.005	.00005	.000005
20	1.6×10^{-1}	1.6	.16	.016	.0016

This test is designed to measure your ability to classify minerals. The minerals named in sets 1 and 2 do not exist. Those in set 3 do exist.

Set 1 Four minerals showed the following results.

MINERAL	WAS SCRATCHED BY	WHEN FRESHLY BROKEN SHOWED	POWDERED COLOUR	LUSTRE
Finite	steel knife	no smooth surfaces	white	pearly
Golite	fingernail	2 smooth surfaces	brown	metallic
Hilite	piece of broken glass	1 smooth surface	white	dull
Jellite	copper coin	3 smooth surfaces	white	glassy

In each of the next five questions use the table above to choose the material which fits the description and mark its letter (A, B, C or D) on your answer sheet.

QUESTION	DESCRIPTION THE MINERAL THAT	MINERALS A	B	C	D
1	has the greatest hardness	finite	golite	hilite	jellite
2	does not reflect light	finite	golite	hilite	jellite
3	has no cleavage	finite	golite	hilite	jellite
4	has a dark streak	finite	golite	hilite	jellite
5	has the most cleavages	finite	golite	hilite	jellite

Set 2 In the table below are the properties of several minerals.

MINERAL	HARDNESS	CLEAVAGE	FRACTURE	STREAK	COLOUR	LUSTRE
Nonite	8	2 at 90°	none	brown	pink	pearly
Pongite	7	none	conchoidal	white	clear	glassy
Quintite	6	none	none	white	gray	metallic
Respite	5	2 at 60°	none	brown	black	dull
Singlite	2	3 at 90°	none	white	white	pearly
Toonite	4	none	none	white	white	glassy
Violite	5	2 at 60°	none	black	black	dull

In each of the next five questions, two minerals are named. Using the table above choose the *property* you would use to find out whether a mineral is one or the other. Mark the letter (A, B, C or D) of the property on your answer sheet.

QUESTION	MINERALS	PROPERTY A	B	C	D
6	Nonite & Respite	hardness	cleavage	fracture	streak
7	Singlite & Toonite	hardness	fracture	streak	colour
8	Pongite & Toonite	cleavage	fracture	streak	lustre
9	Respite & Violite	hardness	cleavage	streak	colour
10	Quintite & Toonite	hardness	cleavage	fracture	streak

Set 3 In the next five questions, two properties are given. Choose the mineral which has those properties and mark its letter (A, B, C or D) on your answer sheet.

QUESTION	MINERAL PROPERTIES	A	B	C	D
11	Hardness = 7, conchoidal fracture	mica	feldspar	calcite	quartz
12	Hardness = 3, 3 cleavage planes	haematite	calcite	quartz	magnetite
13	Hardness = 2, 1 cleavage plane	calcite	quartz	feldspar	mica
14	Hardness = 5.1, magnetic	haematite	calcite	magnetite	mica
15	Hardness = 6, 2 cleavage planes	feldspar	haematite	calcite	quartz

This test requires prior knowledge of the 'activity series of metals' or access to an 'activity series of metals' chart.

The test is designed to measure your ability to make predictions about the relative activity of metals.

SET 1

Choose the metal in each case that is the most active and mark its letter (A, B, C or D) on your answer sheet.

Question	A	B	C	D
1	copper	sodium	zinc	iron
2	potassium	mercury	silver	aluminium
3	magnesium	copper	lead	calcium
4	barium	aluminium	copper	gold
5	lead	zinc	iron	platinum

SET 2

In each line of the table there are four metals, which should be in order from most active to least active. *However, one metal in each group is out of order.*

Choose the letter A, B, C or D which corresponds to the metal that is out of order and mark this letter on your answer sheet.

Question	MOST ACTIVE ⟶ LEAST ACTIVE			
	A	B	C	D
6	aluminium	iron	zinc	copper
7	potassium	iron	lead	magnesium
8	magnesium	zinc	lead	calcium
9	mercury	sodium	barium	silver
10	copper	platinum	mercury	silver

SET 3

In each line of the table, *one metal will be displaced from the solution of its salt* by the metal given in column 1.

Choose the correct solution from which the metal will be displaced and mark its letter (A, B, C or D) on your answer sheet.

Question	Column 1	A	B	C	D
11	iron	sodium nitrate	magnesium nitrate	lead nitrate	calcium nitrate
12	lead	copper nitrate	aluminium nitrate	potassium nitrate	zinc nitrate
13	copper	iron nitrate	mercury nitrate	lead nitrate	potassium nitrate
14	zinc	silver nitrate	barium nitrate	calcium nitrate	sodium nitrate
15	magnesium	barium nitrate	potassium nitrate	sodium nitrate	zinc nitrate

SET 4

In each of the following questions, there are four metals arranged in different orders.

Choose the group of metals which is in the correct order *from least active to most active* and mark its letter (A, B, C or D) on your answer sheet.

Question	A	B	C	D
16	gold mercury copper lead	copper gold mercury lead	lead mercury copper gold	mercury gold copper lead
17	barium calcium potassium sodium	sodium potassium calcium barium	potassium sodium barium calcium	calcium barium sodium potassium
18	iron aluminium magnesium silver	silver iron aluminium magnesium	aluminium iron magnesium silver	magnesium silver iron aluminium
19	platinum copper calcium sodium	copper platinum sodium calcium	calcium copper platinum sodium	sodium copper platinum calcium
20	barium iron lead zinc	iron zinc lead barium	lead iron zinc barium	zinc lead barium iron

This test is designed to test your ability to interpret tapes which have passed through a "ticker timer".

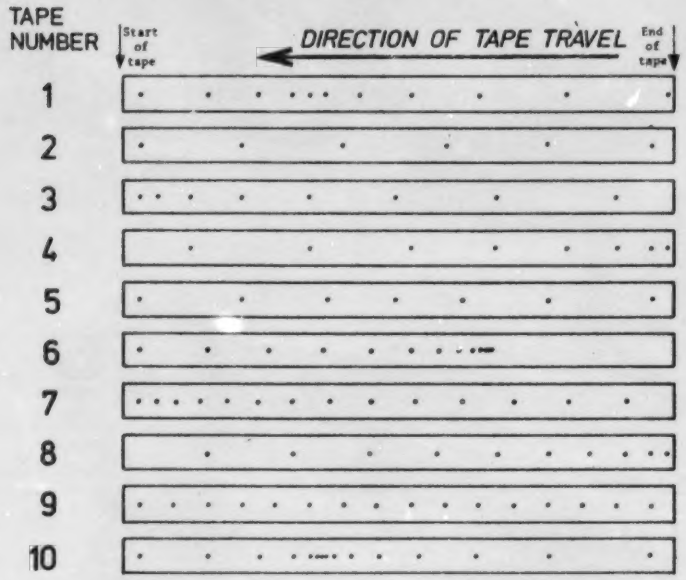
For each question mark your answer sheet like this:

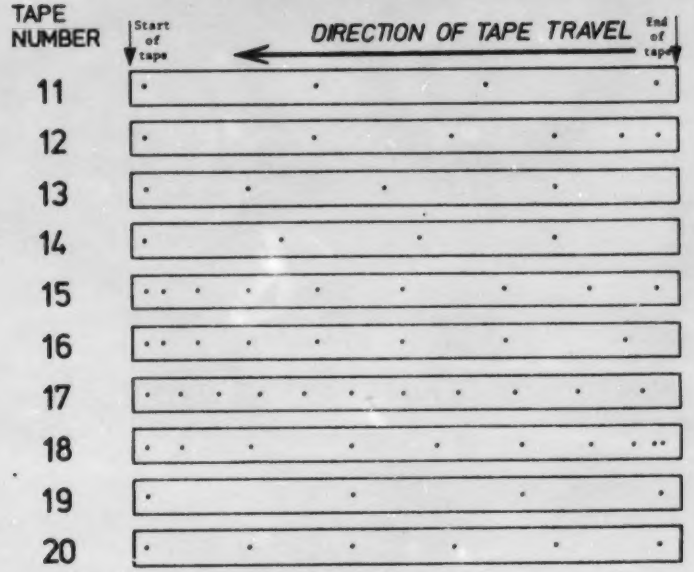
"A": The tape accelerated all through the measurement time.

"B": The tape both accelerated and decelerated all through the measurement time.

"C": The tape moved at constant speed all through the measurement time.

"D": The tape decelerated all through the measurement time.



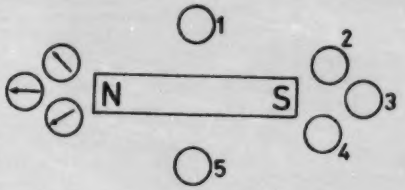


This test is designed to measure your ability to predict the direction of a compass needle in the region around a magnet.

In each of the following questions, 8 magnetic compasses are placed around a magnet as shown.

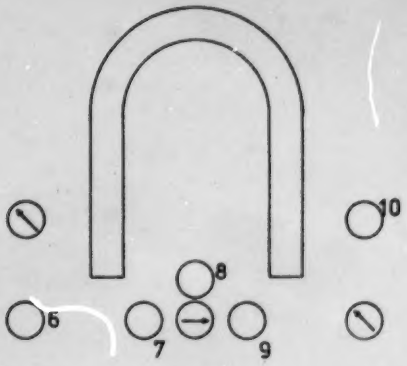
Choose the correct direction in which each numbered compass needle would point and mark the letter (A, B, C or D) on your answer sheet.

Set 1.



QUESTION	COMPASS	ANSWERS			
		A	B	C	D
1	1				
2	2				
3	3				
4	4				
5	5				

Set 2



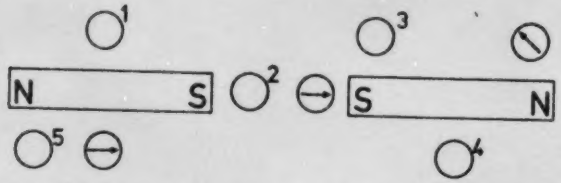
QUESTION	COMPASS	ANSWERS			
		A	B	C	D
6	6				
7	7				
8	8				
9	9				
10	10				

This test is designed to measure your ability to predict the direction of a compass needle in the region around a magnet.

In each of the following questions, 8 magnetic compasses are placed around two magnets as shown.

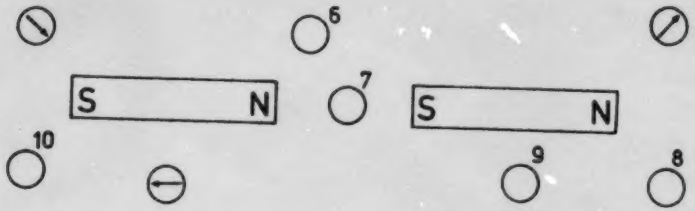
Choose the correct direction in which each numbered compass needle would point and mark the letter (A, B, C or D) on your answer sheet.

Set 1



QUESTION	COMPASS	A N S W E R S A	B	C	D
1	1				
2	2				
3	3				
4	4				
5	5				

Set 2



QUESTION	COMPASS	A N S W E R S A	B	C	D
6	6				
7	7				
8	8				
9	9				
10	10				

This test is designed to test your ability to make calculations by dividing numbers which are written in powers of 10.

For each question select the alternative which is the correct answer. Write the letter of your choice (A, B, C or D) on your answer sheet.

Set 1

QUESTION	PROBLEM	A	B	C	D
1	$10^3 \div 10^2$	2.5	10^1	$10^{3/2}$	10^5
2	$10^5 \div 10^4$	1	10	$10^{\frac{1}{4}}$	10^9
3	$10^4 \div 10^3$	2	$10^{\frac{1}{2}}$	10^7	10^1
4	$10^9 \div 10^9$	1	10^1	10^{18}	10^{81}
5	$10^7 \div 10^4$	10^3	10^4	10^{28}	10^{35}

Set 2

QUESTION	PROBLEM	A	B	C	D
6	$10^3 \div 10^3$	10^0	10^1	1	10^{-1}
7	$10^3 \div 10^{-2}$	10^{-1}	10^1	10^5	10^{-6}
8	$10^{-4} \div 10^2$	- 2	10^{-2}	10^2	10^{-6}
9	$10^{-1} \div 10^{-2}$	- 3	1	10^1	10^{-3}
10	$10^{-4} \div 10^{-2}$	- 2	- 6	10^{-2}	10^{-6}

Set 3

QUESTION	PROBLEM	A	B	C	D
11	$4 \times 10^2 \div 2 \times 10^1$	2×10^1	2×10^3	9×10^1	6×10^3
12	$6 \times 10^4 \div 3 \times 10^2$	2	2×10^2	2×10^4	3×10^6
13	$8 \times 10^2 \div 2 \times 10^1$	40	16×10^2	4×10^1	4×10^4
14	$9 \times 10^{10} \div 3 \times 10^5$	6	3×10^2	6×10^{15}	3×10^5
15	$15 \times 10^3 \div 3 \times 10^1$	5	12×10^3	5×10^2	5×10^{30}

Set 4

QUESTION	PROBLEM	A	B	C	D
16	$6 \times 10^2 \div 3 \times 10^4$	2×10^{-2}	2×10^2	2×10^8	2×10^9
17	$8 \times 10^4 \div 4 \times 10^{-1}$	2×10^{-5}	2×10^4	2×10^4	2×10^3
18	$6 \times 10^{-6} \div 2 \times 10^{-2}$	4×10^{-8}	3×10^{-4}	3×10^{-2}	3×10^2
19	$4 \times 10^{-2} \div 2 \times 10^{-1}$	2×10^{-1}	2×10^{-2}	2×10^1	2
20	$5 \times 10^{-10} \div 5 \times 10^{-5}$	10^{-2}	2	10^{-5}	10^{-15}

This test is designed to test your ability to understand and use Ohm's Law.

Set 1

In the next ten questions, you will find incomplete statements about Ohm's Law. Choose the word or phrase which best completes the statement. Mark its letter (A, B, C or D) on your answer sheet.

QUESTION	STATEMENT	ANSWERS			
		A	B	C	D
1	The equation representing Ohm's Law is:-	I = VR	V = IR	V = I ÷ R	R = IV
2	In the equation representing Ohm's Law, V represents:-	Volume	Voltage	Velocity	Current
3	In the equation representing Ohm's Law, I represents:-	Input	Iron	Current	Copper
4	In the equation representing Ohm's Law, R represents:-	Radius	Resistance	Current	Voltage
5	In Ohm's Law, V is measured in:-	Amps	Ohms	Volts	Watts
6	In Ohm's Law, I is measured in:-	Joules	Amps	Ohms	Watts
7	In Ohm's Law, R is measured in:-	Ohms	Volts	Amps	Newtons
8	If the voltage is doubled in a given electrical circuit, the	current will be doubled	current will be halved	resistance will be doubled	resistance will be halved
9	If the voltage is constant, then to double the current in a circuit, the resistance must be	doubled	halved	kept the same	zero

Set 1 (Continued)

QUESTION	STATEMENT	ANSWERS			
		A	B	C	D
10	If the current is to be kept constant, then if the resistance is halved, the potential difference must be	doubled	halved	kept the same	zero

Set 2

In the next five questions, you will find incomplete statements about the quantities used in Ohm's Law. Choose the word or phrase which best completes the statement. Mark its letter (A, B, C or D) on your answer sheet.

QUESTION	STATEMENT	ANSWERS			
		A	B	C	D
11	Potential Difference (P.D.) is the same as:-	Current	Voltage	Resistance	Power
12	The voltage is measured using:-	an ammeter	a galvanometer	a voltmeter	a barometer
13	The current is measured using:-	an ammeter	a thermometer	a voltmeter	a barometer
14	Resistance can be considered as:-	charge on the move	thickness of a wire	field of a magnet	opposition to electrical flow
15	Current can be considered as:-	electrical pressure	current flowing	electrons flowing	atoms moving

This test is designed to measure your ability to use a code.
The code to be used is the Morse Code which is given below:

A ·−	F ··−·	K −·−	P ·−−·	U ··−
B −···	G −−·	L ·−··	Q −−·−	V ···−
C −·−·	H ····	M −−	R ·−·	W ·−−
D −··	I ··	N −·	S ···	X −··−
E ·	J ·−−−	O −−−	T −	Y −·−−
				Z −−··

For each question in this test, select the correct answer from among those given, and mark its letter (A, B, C or D) on your answer sheet.

Set 1. Which is the correct Morse Code symbol for the letter given?

Question	Letter	Symbol			
		A	B	C	D
1	F	·−·−	−·−·	·−·	··−·
2	M	−−	−·	·−··	··
3	S	···	···−	···	·−−
4	U	···−	··−	−−	·−−−
5	Y	−·−−	−·−−	−−··	−·−−

Set 2.
Which is the correct Morse Code signal for the word given?

QUESTION	WORD	ANSWERS			
		A	B	C	D
6	Lid	−·−· ·· −··	·−·· ·· −−	·−·· ·· −··	·−·· ·− ··
7	Ban	−·−· ·− −·	−··· −· ·−	−··· ·− ··	·−·· ·− −·
8	Top	− −−−− −−··	−− − −··	−·· − ·−··	−− −−·− ·−··
9	Fed	··−· ·· −·	−−·· · ·−·	−·−· ·· −·	·−·· · −··
10	Hug	···· ·· −··	···· ·−· ···	−·−· ·−· −··	···· ·−· −··

Set 3.
Which letter is represented by the Morse symbol shown?

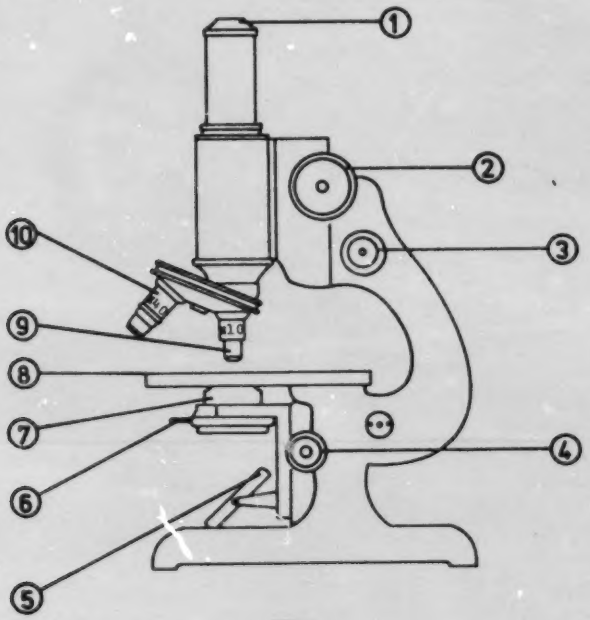
QUESTION	SYMBOL	ANSWERS			
		A	B	C	D
11	−−··	G	H	N	W
12	−−·	K	P	R	X
13	···−	F	J	Q	W
14	−−··	L	P	R	X
15	···	H	I	S	V

Set 4.
Which word is a correct translation of the coded word?

QUESTION	CODE	A	B	C	D
16	−· · ·−· − −·· −·	Newton	Nestle	Newts	Newell
17	·−·· ·−· ··· ····	Pull	Push	Pump	Pant
18	·−·· ·· −−· ···· −	Listen	Light	Legs	Ladle
19	·− ·· −	And	All	Rat	Ant
20	·−· −−− ·−· ·−·	Writ	Walk	Work	Worm

This test is designed to test your ability to name the parts of a microscope and identify their functions.

All questions in this test refer to this diagram:



SET 1

Select the *correct name* for each numbered part and mark its letter (A, B, C or D) on your answer sheet.

Question and part	ANSWERS			
	A	B	C	D
1	eye piece	focus knob	high power objective	low power objective
2	coarse focus control	condenser knob	fine focus control	hinge
3	coarse focus control	condenser knob	fine focus control	hinge
4	aperture control	condenser focus knob	diaphragm	mirror control
5	aperture control	condenser	diaphragm	mirror

SET 1 CONTINUED

Question and part	ANSWERS			
	A	B	C	D
6	condenser focus control	diaphragm control	mirror adjustment knob	stage
7	condenser	diaphragm	mirror	stage
8	aperture	condenser	diaphragm	stage
9	eye piece	high power objective	low power objective	nose piece
10	eye piece	high power objective	low power objective	nose piece

SET 2

Select the *correct function* for each numbered part and mark its letter (A, B, C or D) on your answer sheet.

Question	Part	ANSWERS			
		A	B	C	D
11	1	magnifies and focuses light	allows light onto the slide	adjusts focus	reduces brightness of light
12	2	adjusts "coarse" focus	adjusts high power objective	adjusts low power objective	adjusts "fine" focus
13	3	adjusts "coarse" focus	adjusts high power objective	adjusts low power objective	adjusts "fine" focus
14	4	moves condenser	adjusts "fine" focus	adjusts "coarse" focus	moves slide
15	5	holds slide	focusses image	controls light reaching slide	directs light upwards
16	6	focuses light	controls light reaching slide	holds slide	light switch
17	7	focuses light on the object	magnifies light	controls field of view	moves slide
18	8	controls brightness	focusses light	holds slide	magnifies light
19	9	high power magnification	low power magnification	controls "coarse" focus	controls "fine" focus
20	10	high power magnification	low power magnification	controls "coarse" focus	controls "fine" focus

This test is designed to measure your ability to work out relative densities and to predict what substances will float on another substance.

Set 1

The next five questions refer to this table:

SUBSTANCE	MASS (kg)	VOLUME (litres)
E	5	2
F	5	4
G	6	8
H	10	8
J	7	7

Choose the correct answer for each question given below, and mark its letter (A, B, C or D) on your answer sheet.

QUESTION	DESCRIPTION	POSSIBLE ANSWERS			
		A	B	C	D
1	The substance with a density of less than one.	E	F	G	H
2	The most dense substance.	E	J	H	J
3	The substance with density = 1.	F	G	H	J
4	Two substances with the same density.	E & F	E & G	F & H	G & H
5	The substance with a density of 2.5.	E	G	H	J

Set 2

This table gives the information needed for the next ten questions.

Liquid	Density
K	0.8
L	1.0
M	1.1
N	1.7
P	13.6

Solid	Density
Q	0.7
R	1.0
S	1.5
T	7.0
V	15.0

QUESTION	DESCRIPTION	POSSIBLE ANSWERS			
		A	B	C	D
6	A substance that will float on L:	K	M	S	T
7	A substance that will float on N:	P	S	T	V
8	A substance that S will float on:	K	L	M	N
9	A substance that will sink in N:	Q	R	S	T
10	A substance that will sink in M:	K	L	Q	S
11	A substance that will not sink or float in L:	K	M	R	S
12	A liquid in which both Q and S will float:	K	L	M	N
13	A liquid in which V and R will both sink:	K	M	N	P
14	A liquid in which R will float and S will sink:	K	L	M	N
15	A substance that will float on P and sink in N:	Q	S	T	V

This test is designed to test your ability to estimate size using S.I. units.

SET 1

The next five questions require you to estimate the length of a common object in *millimetres*. Make your own estimate, and choose the size nearest to that from the choices given. Mark the letter of that answer (A, B, C or D) on your answer sheet.

Question	Object	ANSWERS IN MILLIMETRES			
		A	B	C	D
1	match	20	50	100	150
2	height of large test tube	150	200	250	300
3	height of milk bottle	100	200	300	400
4	width of single door	200	400	600	800
5	height of door	1 000	1 500	2 000	2 500

SET 2

The instructions for the next five questions are the same as for Set 1, but the answers are in *metres*.

Question	Object	ANSWERS IN METRES			
		A	B	C	D
6	height of your school desk	1	2	3	4
7	height of the door of this room	1	1.5	2	2.5
8	height of this room	2	3	4	5
9	height of a "telegraph" pole	5	10	15	20
10	height of a ten storey building	10	20	30	40

SET 3

In the next ten questions, a size is given in *either* millimetres or metres. Choose the object which has that size as its BIGGEST MEASUREMENT. Mark its answer (A, B, C or D) on your answer sheet.

Question	Size	ANSWER OBJECTS			
		A	B	C	D
11	10 mm	diameter of a 1 cent coin	diameter of a 20 cent coin	length of a stick of chalk	height of a Bunsen burner
12	100 mm	diameter of a 50 cent coin	length of a stick of chalk	length of a ball point pen	length of a human foot
13	250 mm	length of an index finger	lab stool height	length of a human foot	length of elbow to finger tip
14	500 mm	lab stool height	door height	room height	"telegraph" pole height
15	1000 mm	width of hand	length of car	length of a baseball bat	length of a cricket pitch
16	0.5 metres	length of a fore-arm	length of a hockey stick	door height	door width
17	1 metre	length of a tennis racquet	length of a hockey stick	room height	length of a car
18	5 metres	height of double decker bus	length of a cricket pitch	length of a tennis court	length of a billiard table
19	10 metres	height of a 5 storey building	room height	length of a car	length of a bus
20	20 metres	length of a squash court	length of a football field	length of a cricket pitch	length of a hockey field

This test is designed to measure your ability to change units from words to symbols.

Use the following units and symbols to answer the questions.

UNIT	SYMBOL
metre	m
litre	L
second	s
minute	min
newton	N

UNIT	SYMBOL
millilitre	mL
gram	g
kilogram	kg
kilometre	km

You may need to know that "per" and "/" both mean "divided by". You may also need to know that "x.y" means "x multiplied by y".

SET 1

Choose the correct symbol for each unit and mark its letter (A, B, C or D) on your answer sheet.

Question	Unit	Possible Answers			
		A	B	C	D
1	metres per second	ms	m/s	m÷s	m.s
2	newton metres	N.m	N/m	N÷m	Nm
3	kilometres per minute	km	km.min	km/min	km÷min
4	litres per kilogram	L.kg	L.g	L÷kg	L/kg
5	grams per second	g.s	s.g	s/g	g/s

SET 2

Choose the correct unit for each symbol and mark its letter (A, B, C or D) on your answer sheet.

Question	Symbol	Possible Answers			
		A	B	C	D
6	L/s	litres per second	second litre	litre ÷ seconds	litres second
7	m/km	metre kilometres	metres per kilometre	metres ÷ kilometres	millilitres per second
8	g/N	gram Newtons	grams per Newton	grams ÷ Newtons	Newton grams
9	N.s	Newtons	Newtons per second	Newtons ÷ seconds	Newton seconds
10	kg/min	kilometres per minute	kilogram per metre	kilograms per minute	kilogram minutes

SET 3

Choose the correct symbol for each unit and mark its letter (A, B, C or D) on your answer sheet.

Question	Unit	Possible Answers			
		A	B	C	D
11	kilogram × metre ÷ second	kg.m.s	kg/m.s	k/m/s	kg.m/s
12	metre ÷ second ÷ second	m/s.s	m.s/s	m/s^2	m.s.s
13	Newtons ÷ metres squared	$(N/m)^2$	N^2/m	$N.m^2$	N/m^2
14	litres × seconds × metres	L.s.m.	L/s/m	L÷s÷m	L/s.m
15	kilograms ÷ kilometre	kg.km	kg/km	Km/kg.m	km.kg

This test is designed to measure your ability to apply the equation $s = vt$.

where s = distance in metres
v = velocity in metres/sec.
t = time in seconds.

SET 1

Choose the correct velocity for each question and mark its letter (A, B, C or D) on your answer sheet.

Question	Distance travelled (metres)	Time taken to travel distance (seconds)	Possible Velocities (m/s)			
			A	B	C	D
1	10	5	$\frac{5}{10}$	2	4	15
2	100	10	$\frac{1}{10}$	5	10	20
3	440	20	$\frac{1}{22}$	10	18	22
4	1000	50	$\frac{1}{50}$	$\frac{1}{20}$	15	20
5	1600	80	$\frac{1}{80}$	$\frac{1}{20}$	20	50

SET 2

Choose the correct distance a car would travel for each of the specific sets of information.

Question	Velocity (m/s)	Time (secs)	Possible Distances (m)			
			A	B	C	D
6	35	1.0	$\frac{1}{35}$	17	35	70
7	50	0.5	10	25	50	250
8	80	2.0	16	40	80	160
9	100	3.5	35	70	175	350
10	120	5.0	60	240	600	1200

SET 3

Choose the correct time it would take an object, to travel the distance s at velocity v given below.

Mark its letter (A, B, C or D) on your answer sheet.

Question	Distance (s) m	Velocity (v) m/s	Time (secs.)			
			A	B	C	D
11	100	200	$\frac{1}{2}$	2	100	200
12	100	300	$\frac{1}{30}$	$\frac{1}{3}$	3	300
13	$\frac{1}{2}$	200	$\frac{1}{100}$	$\frac{1}{200}$	$\frac{1}{400}$	$\frac{1}{1000}$
14	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{5}{100}$	$\frac{1}{10}$	1	5
15	20	$\frac{1}{2}$	10	40	100	400

SET 4

This set is designed to identify problems which you may have shown in the first three sets. In each question, use the equation given for that question to find the correct answer, and mark its letter (A, B, C or D) on your answer sheet.

Question	Given Equation	Find	ANSWERS			
			A	B	C	D
16	$x = 2y$	y	$2x$	x	$\frac{x}{2}$	x^2
17	$y = \frac{x}{z}$	z	yz	$\frac{z}{y}$	$\frac{y}{z}$	$y + z$
18	$y = \frac{x}{z}$	z	$\frac{x}{y}$	$\frac{y}{x}$	xy	$x + y$
19	$x = yz$	y	$\frac{1}{x}$	$\frac{x}{z}$	xz	$x + z$
20	$z = yz$	z	$\frac{x}{y}$	$\frac{y}{x}$	xy	$x + y$

This test is designed to measure your ability to understand and apply the knowledge in a scientific theory.

Read the theory below and then answer the questions which follow.

The Theory

Scientists on the planet Xenos have an atomic theory which is based on the assumption that an atom is composed of a central nucleus with negons arranged in successive orbits around it.

Each orbit, starting with the one closest to the nucleus, can hold a maximum number of negons as shown in the table.

Orbit Number	Max. No. negons in this orbit	Total number of negons if orbit full
1	3	3
2	6	9
3	12	21
4	18	39

The nucleus contains particles called plusons, in equal numbers to the negons in orbit. This number (the number of plusons in the nucleus) is also called the Reference number of each element.

Orbiting negons are arranged such that the first orbits fill up completely before a negon goes into a new orbit.

The stability of the atoms depends upon the number of negons in the orbit which is furthest from the nucleus - atoms with larger numbers of negons in their outside orbit are more stable than those with fewer negons.

SET 1

Choose the correct number of negons in the outside orbit of each atom and mark its letter (A, B, C or D) on your answer sheet.

Question	Total No. of negons possessed by atom in this question	No. negons in outside orbit of atom			
		A	B	C	D
1	4	1	2	3	4
2	7	1	3	4	6
3	9	2	3	5	6
4	12	1	3	4	6
5	27	3	5	6	9

SET 2

Choose the correct reference number for the atoms listed (6 - 10) and mark the letter (A, B, C or D) on your answer sheet.

Question	Number of orbits containing negons	No. of negons in outside orbit	Reference No.			
			A	B	C	D
6	1	1	1	2	3	4
7	2	4	4	7	9	10
8	3	7	7	9	16	19
9	4	5	5	12	17	26
10	5	10	10	22	28	49

SET 3

Choose the most stable atom and mark its letter (A, B, C or D) on your answer sheet.

Question	Total number of negons			
	A	B	C	D
11	1	2	3	4
12	6	7	8	9
13	9	10	11	12
14	20	21	22	23
15	7	16	26	33

SET 4

Choose the correct total number of negons for each atom and write its letter (A, B, C or D) on your answer sheet.

Question	Number of Orbits containing negons	Number of negons in last orbit	Possible Total Number of negons			
			A	B	C	D
16	1	2	1	2	3	4
17	2	3	3	5	6	9
18	3	4	10	13	21	25
19	4	5	17	23	26	44
20	5	6	24	30	45	63

This test is designed to measure your ability to determine the magnification of a microscope. For each question choose the correct answer and write the letter (A,B,C or D) on your answer sheet.

SET 1: What magnification would you get if you were using a microscope with the following eyepiece and objective?

Ques.	Eyepiece	Objective	Magnification			
			A	B	C	D
1.	5	10	5	15	50	100
2.	5	40	8	35	45	200
3.	10	10	1	10	20	100
4.	10	20	20	30	200	210
5.	12.5	20	125	250	290	1200

SET 2: Which eyepiece and objective would you use to get the magnification indicated?

Ques.	Magnification	A		B		C		D	
		Obj.	Eye p.	Obj.	Eye p.	Obj.	Eye p.	Obj.	Eye p.
6.	40	×10	×4	×10	×8	×20	×20	×40	×10
7.	100	×10	×5	×10	×10	×50	×10	×20	×10
8.	200	×10	×12.5	×20	×10	×50	×5	×20	×20
9.	500	×10	×40	×25	×2	×50	×10	×100	×20
10.	1000	×40	×20	×50	×10	×50	×20	×100	×20

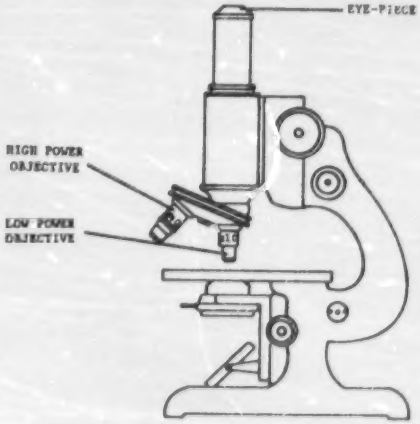
SET 3: A student using a microscope was observing using the magnification and eyepiece shown. What would be the new magnification if the eyepiece was changed to the value shown?

Ques.	Magnification used	Eye piece used	New Eye piece	New Magnification			
				A	B	C	D
11.	×100	×5	×10	50	150	200	1000
12.	×200	×10	×5	40	100	150	400
13.	×250	×12.5	×5	62.5	100	500	1000
14.	×400	×5	×20	800	1000	1200	1600
15.	×500	×10	×12.5	350	475	625	1250

SET 4: A student using a microscope used the magnification and eyepiece shown. If he wanted to use the new magnification, what new eyepiece would he use?

Ques.	Magnification used	Eye piece used	New magnification	New Eyepiece			
				A	B	C	D
16.	×100	×5	×200	×2.5	×10	×12.5	×20
17.	×200	×10	×600	×3	×25	×30	×40
18.	×250	×12.5	×100	×5	×10	×20	×25
19.	×500	×10	×750	×1.5	×2.5	×5	×15
20.	×1000	×20	×400	×2.5	×8	×20	×30

This test is one of a number of tests which may be used to determine readiness for a particular task. In this case the task is any form of biology requiring microscopy coupled to an understanding of scale.



M47

This test is designed to measure your ability to recognise trends in various aspects of Science.

For each question choose the correct answer and write the letter (A, B, C or D) on your answer sheet.

Examine the sets of data given in questions 1-5 and determine the missing quantity.

Question	Data		Possible Answers			
	p	t	A	B	C	D
1.	0	0				
	(?)	1				
	9	2	1	3	5	7
	27	3				
	81	4				
2.	(?)	1				
	4	2	0	1	2	3
	9	3				
	16	4				
3.	10	5				
	20	10				
	30	15	32	34	35	38
	(?)	16				
	40	20				
4.	0	0				
	5	1				
	15	2	40	45	50	55
	30	3				
	(?)	4				
5.	3	0				
	5	1				
	7	2	43	45	47	49
	9	3				
	(?)	20				

036 71

Set 2

Which is the correct missing formula for each space in the table?

Question	Data				Possible Answers			
					A	B	C	D
6.	CH_4	C_2H_6	?	C_4H_{10}	C_3H_8	C_3H_7	C_3H_6	C_3H_5
7.	C_2H_4	C_3H_6	C_4H_8	?	C_5H_{10}	C_5H_{12}	C_6H_{10}	C_6H_{12}
8.	C_2H_2	?	C_4H_6	C_5H_8	C_3H_3	C_3H_4	C_3H_5	C_3H_6
9.	C_6H_{12}	$C_6H_{10}Cl_2$	$C_6H_8Cl_4$	?	$C_6H_6Cl_4$	$C_6H_8Cl_4$	$C_6H_6Cl_2$	$C_6H_8Cl_2$
10.	CH_3CHO	?	C_4H_7CHO	C_5H_9CHO	HC_2CHO	C_2HCHO	C_2H_3CHO	C_2H_5CHO

WARNING!! THIS SET IS MUCH HARDER!!

Set 3 Successive ionisation energies of elements hydrogen to sodium in energy units.

Electrons-outermost to innermost

Element	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
H	300									
He	550	1 250								
Li	100	1 750	2 800							
Be	(P)	450	3 550	5 050						
B	200	600	900	6 000	7 850					
C	250	550	1 100	1 500	(R)	11 400				
N	350	700	1 100	1 800	2 250	12 700	(S)			
O	300	800	1 250	1 800	2 600	3 200	17 100	20 100		
F	400	800	1 650	2 000	2 650	3 600	4 250	22 000	25 300	
Ne	500	950	1 500	2 250	2 900	3 650	4 800	(T)	27 400	31 300
Na	100	1 100	1 650	(Q)	3 200	4 000	4 800	6 100	6 900	33 700

Question		Possible Answers			
		A	B	C	D
11.	P	100	150	200	250
12.	Q	1 400	1 800	2 100	2 400
13.	R	1 600	2 000	3 600	10 000
14.	S	10 000	12 000	15 000	18 000
15.	T	5 500	10 000	17 000	24 000

This test is designed to measure your ability to apply your knowledge of averages to some experimental situations. For each question choose the correct answer and write the letter (A,B,C, or D) on your answer sheet.

SET 1

Question	Experiment	A	B	C	D
1	3 students each measured the mass of a rock and found it to be 6.0, 6.1 and 6.2 grams. What is the average mass of the rock?	6.0	6.1	6.15	6.2
2.	The volume of a rock was measured by 2 students and found to be 16.0 mL and 16.2 mL. What was the average volume?	16.0	16.1	16.15	16.2
3.	4 students found the diameter of a filter paper to be 10, 10.1, 10.2 and 10.4 cm. The average diameter of the paper is nearest to	10.0	10.1	10.2	10.3
4.	The time taken for a cylinder to fill from a dripping tap was found to be 36,37,38 and 39 seconds by 4 students. The average time is closest to	36.5	37.0	37.5	38.0
5.	The mass of a collision trolley was found to be 1000 g, 1010 g, 1026 g by 3 students. The average mass of the trolley is	1009	1012	1015	1018

SET 2

Question	Experiment	A	B	C	D
6.	If 10 matches have a mass of 2.3 grams, then the mass of 1 match is nearest (in grams) to	0.23	2.3	12.3	2.3
7.	A student added 6 tubes of water to a measuring cylinder and filled it to the 90 mL mark. The average volume of the tube is (in mL).	6	12	15	18
8.	If a student timed 30 drops from a dripping tap in 2 minutes, then the average time between drops is (in secs)	1	2	3	4
9.	If 11 drops of water have a volume of 10mL, then the volume of one drop is nearest (in mL)to	0.9	1.0	1.1	2
10.	50 spoonsful of water were needed to fill a 250 mL beaker. The volume of one spoonful (in mL) is nearest to	2.5	5	10	15

SET 3

Question	Experiment	A	B	C	D
11.	The average mass of two brass cubes is 50g, and one has a mass of 49.8g. The mass of the other is nearest (in grams) to	0.2	49.9	50.1	50.2
12.	A student measured 3 lengths of wire and found the average length to be 5.0 cm. He found 2 lengths to be equal at 5.1 cm. The third (in cm) is nearest to	4.8	4.85	4.9	5.0
13.	If the average volume of three test tubes is 16mL, and the smallest has a volume of 14mL, then the largest would have a volume (in mL) of	15	16	16.5	17
14.	Students were told that the average mass of 6 rocks was 56 grams. If 5 of the masses total 286 grams, then the mass of the 6th rock (in grams) is nearest to	48	50	53	56
15.	The average height of three students was found to be 150 cm. If the tallest was 160 cm, then the shortest could be	120	125	144	150

N.B.: All usages in this test have been chosen to conform with guidelines laid down by the Metric Conversion Board.

This test is designed to measure your ability to apply a theory of genetics to an example. For each question choose the correct answer and write the letter (A, B, C or D) on your answer sheet. The questions refer to this information:

Scientists on the planet Xenos studied the genetics of an animal which they called an XINSECT.

They observed that characteristics of the XINSECT were either DOMINANT (if present, they always appeared in offspring) or RECESSIVE (only appeared if both parents had them).

They listed the following characteristics, and the symbols they decided to use for the characteristics.

CHARACTERISTIC	DOMINANT	SYMBOL	RECESSIVE	SYMBOL
wing pattern	plain	W	spotted	w
antennae	straight	A	curly	a
eye colour	black	E	white	e
eye shape	round	R	square	r
wing size	large	S	small	s
body pattern	striped	P	plain	p
body shape	chunky	B	slender	b
stinger	yes	T	no	t
body covering	fur	F	plain	f
number of wings	4	N	2	n

Set 1: For questions 1-5, choose the most likely characteristics (in symbol form) for an offspring of the parents shown.

Q	MALE PARENT	FEMALE PARENT	POSSIBLE OFFSPRING			
			A	B	C	D
1.	WER	wer	WER	Wer	WEr	WeR
2.	ASp	aSp	ASP	ASp	Asp	aSP
3.	ePb	epb	EPB	EPb	ePb	epb
4.	tfn	tfn	TFN	tfN	tFn	tfn
5.	rbf	RBf	RBF	RBf	rbF	Rbf

Set 2: For each question (6-10) choose the most probable offspring from mating the parent Xinsects shown.

Q	MALE PARENT	FEMALE PARENT	POSSIBLE OFFSPRING			
			A	B	C	D
6.	plain wings straight antennae white eyes	spotted wings curly antennae black eyes	plain straight black	plain curly white	plain curly black	spotted straight white
7.	plain wings small wings slender body	plain wings large wings slender body	plain large chunky	plain large slender	spotted small slender	spotted large slender

Set 2 (Continued)

Q	MALE PARENT	FEMALE PARENT	POSSIBLE OFFSPRING			
			A	B	C	D
8.	striped body chunky body stinger	plain body slender body no stinger	plain slender no stinger	plain slender stinger	plain chunky stinger	striped chunky stinger
9.	black eyes square eyes no fur	black eyes round eyes fur	black square fur	black square no fur	black round fur	black round no fur
10.	spotted wings straight antennae plain body	plain wings curly antennae plain body	plain straight plain	plain straight striped	spotted straight plain	plain curly striped

Set 3 Here are two parent Xinsects. Both are pure-breeding.

For questions 11-15, choose the characteristics which could be present in the offspring of the two Xinsects shown above.

Q	CHARACTERISTICS	POSSIBLE OFFSPRING			
		A	B	C	D
11.	wing pattern antennae	plain straight	plain curly	spotted straight	spotted curly
12.	eye colour eye shape	black round	black square	white round	white square
13.	wing size body pattern	small plain	small striped	large plain	large striped
14.	body shape stinger	chunky yes	chunky no	slender yes	slender no
15.	body covering number of wings	plain 2	plain 4	fur 2	fur 4

M49

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This test is designed to measure your ability to multiply numbers written in powers of ten.
For each question select the correct answer and write its letter (A,B,C or D) on your answer sheet.

SET 1

Question	Problem	A	B	C	D
1.	$1 \times 10^{3} \times 1 \times 10^{3}$	1×10^{6}	2×10^{6}	1×10^{9}	2×10^{9}
2.	$1 \times 10^{3} \times 2 \times 10^{2}$	2×10^{5}	3×10^{5}	2×10^{6}	3×10^{6}
3.	$2 \times 10^{1} \times 3 \times 10^{4}$	5×10^{4}	6×10^{4}	5×10^{5}	6×10^{5}
4.	$3 \times 10^{2} \times 3 \times 10^{5}$	6×10^{7}	9×10^{7}	6×10^{10}	9×10^{10}
5.	$4 \times 10^{2} \times 2 \times 10^{4}$	6×10^{6}	8×10^{6}	6×10^{8}	8×10^{8}

SET 2

Question	Problem	A	B	C	D
6.	$9 \times 10^{-2} \times 9 \times 10^{5}$	18×10^{-10}	81×10^{-10}	8.1×10^{3}	1.8×10^{4}
7.	$8 \times 10^{-2} \times 9 \times 10^{4}$	7.2×10^{-1}	1.7×10^{3}	17×10^{10}	72×10^{10}
8.	$6 \times 10^{-3} \times 7 \times 10^{2}$	42×10^{-6}	13×10^{-1}	4.2×10^{2}	1.3×10^{3}
9.	$4 \times 10^{-2} \times 5 \times 10^{2}$	20×10^{-10}	9×10^{-2}	9×10^{2}	2×10^{4}
10.	$4 \times 10^{-3} \times 3 \times 10^{7}$	12×10^{-5}	1.2×10^{3}	1.2×10^{6}	7×10^{9}

SET 3

Question	Problem	A	B	C	D
11.	$2 \times 10^{-6} \times 3 \times 10^{9}$	5×10^{-15}	6×10^{-15}	5×10^{3}	6×10^{3}
12.	$8 \times 10^{4} \times 9 \times 10^{-6}$	7.2×10^{-20}	1.7×10^{-20}	17×10^{-2}	7.2×10^{-1}
13.	$10 \times 10^{-7} \times 10 \times 10^{3}$	100×10^{-14}	2.0×10^{-20}	20×10^{-4}	1.0×10^{-3}
14.	$15 \times 10^{12} \times 3 \times 10^{-20}$	4.5×10^{-1}	18×10^{-8}	45×10^{2}	18×10^{2}
15.	$20 \times 10^{12} \times 3 \times 10^{-20}$	23×10^{-8}	60×10^{-20}	6.0×10^{-8}	23×10^{2}

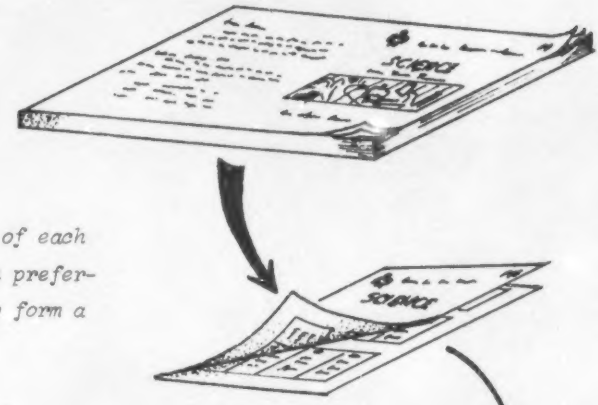
SET 4

Question	Problem	A	B	C	D
16.	$2 \times 10^{-2} \times 3 \times 10^{-3}$	5×10^{-5}	6×10^{-6}	5×10^{-6}	6×10^{-6}
17.	$3 \times 10^{-2} \times 4 \times 10^{-6}$	1.2×10^{-7}	7×10^{-8}	12×10^{9}	12×10^{10}
18.	$4 \times 10^{-3} \times 6 \times 10^{-9}$	24×10^{-6}	2.4×10^{-20}	10×10^{-11}	1.0×10^{-10}
19.	$7 \times 10^{-4} \times 8 \times 10^{-7}$	15×10^{-4}	5.6×10^{-12}	5.6×10^{-11}	56×10^{-12}
20.	$10 \times 10^{-4} \times 10 \times 10^{-6}$	100×10^{9}	1.0×10^{2}	20×10^{-3}	1×10^{-4}

SOME STORAGE SUGGESTIONS

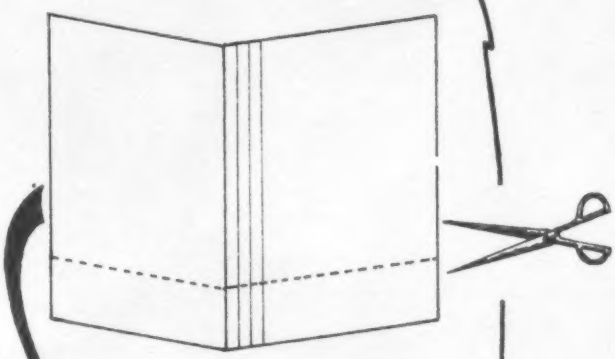
1. *Don't leave them on the pad they very quickly become "dog-eared" and unserviceable.*

2. *Tear off the copies of each individual test then preferably fold in half to form a leaflet.*



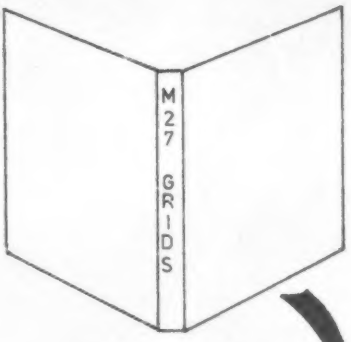
3. *Take a manilla folder (preferably the type which has multiple folds to allow varying amounts of paper to be stored.)*

4. *Trim to size.*



5. *Label the "spine" with test number and name.*

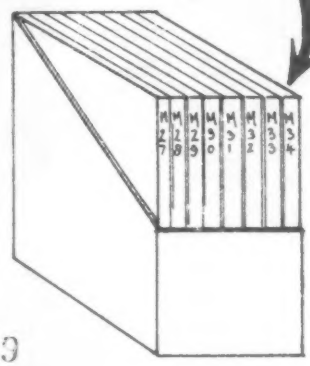
6. *Place class set in the folder.*



7. *Use an empty wine or orange juice cask (4.5 L) as follows.*

   (i) turn the cask upside down.
   (ii) cut away base and sides.
   (iii) place class sets in folders.
   (iv) place class sets in folders in the cask.

   (v) this can hold class sets of about ten tests - so five casks will have series 1-4 neatly stored for multiple use.



Appendix 1

ORDER FORM FOR SETS OF MASTERY TESTS

TO: The Chief Services Officer
School Certificate Development Unit,
P.O. Box 460, NORTH SYDNEY 2060

Please send me the following sets of Science Mastery tests

TITLE See checklist on facing page: where space is insufficient, attach photocopies of this form.	Number of Tests Required	
	Sets of 20	Half Sets of 10

I certify that the quantity specified is the minimum appropriate to the requirements of this school. .... Head of Department.

.....
(Principal's Signature) / /

SCHOOL: _____

ADDRESS: _____

_____

_____ POSTCODE: _____

Please keep a photocopy of this order, for your records.

CUT ALONG THIS LINE

Appendix 2

MASTERY TESTS

ANSWER SHEET & RECORD

Name_____

Class_____

	MASTERY TEST NUMBERS									
Question										
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
SCORE										
Mastery										
Date										

USING THE MASTERY ANSWER SHEET

An Example

MASTERY TESTS

ANSWER SHEET & RECORD

Name M. ASTERY

Class 8Y

	MASTERY TEST NUMBERS									
Question	27	27	30	32	32	32	41	29	36	37
1	D ✓	D ✓	B ✓	C ✓	C ✓	C ✓	D ✓	B ✓	A ✓	D ✓
2	C x	B ✓	A ✓	B x	C ✓	C ✓	A ✓	D ✓	B ✓	B ✓
3	A x	D ✓	C x	A ✓	A ✓	A ✓	C x	D ✓	C ✓	B ✓
4	A ✓	A ✓	C ✓	B ✓		B ✓	C ✓		B ✓	
5	C ✓	C ✓	A ✓			D ✓	D x		✓	
6	B x	A x	D ✓							
18	C ✓	C ✓	–	–	–	–	–	D ✓	–	B x
19	B x	A x	–	–	–	–	–	D ✓	–	A ✓
20	A ✓	A ✓	–	–	–	–	–	A ✓	–	C ✓
SCORE	14/20	18/20	14/15	10/15	11/15	14/15	13/15	20/20	9/10	17/20
Mastery	NO	YES	YES	NO	NO	YES	YES	YES	YES	YES
Date	16/5	21/5	3/6	10/6	11/6	12/6	27/6	19/7	23/7	5/8

This answer sheet is provided as an alternative to that in the "Introduction and Manual". The intent of this revised answer sheet is somewhat different in that it enables a cumulative record of a student's attempts at mastery tests to be maintained.

Since the true implementation of a Mastery testing Programme must allow for a student to attempt a single test more than once if not mastered initially, then it is essential that the student's attempts be recorded. The provision of a MASTERY column, and a DATE column enables the outcome, and time of attempt to be recorded.

The example page included above shows that a student, M. Astery of 8Y; attempted tests M27, and M32 more than once before achieving mastery. Such a profile would help the teacher determine those aspects of the work covered by 8Y which this particular student found difficult.

i.e. use of grids and mineral identification.

If such information were also found evident from other students' profiles, then it may be that the teaching of such aspects of a work unit needed some revisions. We may thus use student assessment of a criterion-referenced nature to provide us with evaluation information re our programs and teaching methods.